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ATOMIC ENERGY COMMISSION

RAISING RADIOLOGICAL SAFETY CRITERIA FOR TESTS

Note by the Secretary

The attached letter from Dr. Clinton S. Maupin of Reynolds Electrical and Engineering Company is circulated for the information of the Commission. Copies have been sent to the General Manager for appropriate action and to the Director of Regulation for information.

W. B. McCool

Secretary

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REYNOLDS ELECTRICAL AND ENGINEERING CO., INC.

November 15, 1961

Raising the Radiological Safety
Criteria for Tests

James E. Reeves, Assistant Manager

U. S. Atomic Energy Commission
Office of Field Operation
Post Office Box 2088
Las Vegas, Nevada

Gentlemen:

Hazards are measured by their seriousness and by their frequency of occurrence. Efforts are made to control circumstances leading to hazardous conditions by applying rules and regulations to minimize both the frequency of occurrence and the severity. The term inherently denotes a risk or a danger which would result in some sort of injury to persons or things. As such, the aim of any safety program is to control conditions so that injuries are infrequent and the chance of their being severe is reduced. In practice, all reasonable measures are taken to achieve safe operations. Reasonable in this sense means that the extent of such efforts will not be economically infeasible from a cost standpoint nor be so difficult to achieve and so time consuming that they interfere with the work completion. Regardless of the effort put out, the only method of completely preventing accidents and injuries is to cease operation.

In considering radiation hazards, attempts have been made to prevent injuries to individuals by establishing exposure criteria which are extremely stringent. The general approach to this problem arises out of the unproven concept that all radiation exposure is harmful regardless of amount or rate of acquisition. As such, peace time maximum permissible exposure levels have been made exceedingly low on the grounds that possible genetic effects of a deleterious nature or life shortening will result to those who receive extremely low-level exposures over a working lifetime.

Considerable work has been done by the Military to try to determine what is an injurious dose of radiation; injuries being defined in this case as that quantity of radiation which would render troops non-effective to a very mild degree. All evidence points to the fact that this type of injury will occur only if an acute dose of whole-body radiation received in a period of 24 hours or less exceeds 200 Rad. Non-effectiveness of troops as units is not assumed to occur at values less than 200 Rad. Symptoms of radiation sickness of a subjective nature other than psychological, are not expected to occur, nor have they been observed in doses less than 100 Rad.

With the finest laboratory techniques, excellent technicians, with a series of base line laboratory procedures consisting of blood counts several times a day over a period of several weeks, it might be possible to detect exposures as low as

25 Rad of acute whole-body radiation if any aberrations in the counts go outside the probable error of the base line. No connection between prolonged radiation in the low dose range less than 100 R has definitely been shown between radiation and the three conditions of consideration: life shortening, deleterious genetic effects, and leukemogenesis. There is some evidence that in the higher dose ranges among the Japanese survivors from Hiroshima and Nagasaki that there is an increased incidence of leukemia. However, in the Rongelap natives who received an estimated 175 R from fallout radiation in 48 hours, no cases of leukemia have occurred during the seven years following their exposure. It has also been shown that the effects on biological systems is less when the total dose is received over a period of days, weeks, or longer, than if received in a short period of time. Consequently, any quarterly dose of radiation received, or yearly aggregate, is certainly less effective than the same dose received as acute radiation. It is certain that aggregate doses in the vicinity of 25 R per year are definitely less effective biologically than 25 R of acute radiation, which is the ultimate limit of determination of radiation response of humans from an objective standpoint. An exposure limit of 3 R per quarter and 5 R per year is obviously an extremely safe limit when considered from a standpoint even of subjective findings and completely outside the spread of subjective symptoms of injury

The previously adopted test operations criteria of 3.9 R per quarter, with the prerogative of the Test Manager to increase the exposure limits to doses required to complete an urgently required operation up to even 25 R, has so far not resulted in any detectable damage in operational personnel through 14 test series. As a matter of fact, with the exception of highly urgent projects, it has been possible to accomplish most of the work within the 3.9 R per quarter limit. During the present operation, in spite of great efforts to comply with radiological safety regulations, including rigid controls, hiring additional personnel for rotation purposes, and thrice daily processing of film badges, it has not been possible to achieve the ultimate goal of no one receiving more than 3 R per quarter or 5 R per year As long as the requirements and extreme pressures exist to meet schedule dates, it will probably not be possible to continue similar operations without again exceeding the maximum permissible doses.

It is my opinion that we have gone past all reasonable effort to live with the current criteria because it appears that economically, fiduciarily, and from a standpoint of human effort, the law of diminishing returns is prevailing. These conditions will continue to prevail as long as the unreasonable and unrealistic attitude of considering low-level exposures of a non-effect-producing variety to be more serious and more horrible than accidents up to and including death from conventional construction operations and vehicle travel. Necessary defense work will be hampered and other conventional-type hazards which will begin to be apparent subjectively and objectively will occur more frequently as a result of fatigue and utilization of inexperienced personnel in critical positions. It is my studied, professional opinion that the only sensible thing to do is to increase the maximum permissible allowable exposure to realistic levels as long as any yearly dose does not reach or exceed the lowest dose in which one might expect to find subjective signs or symptoms, namely, 25 R.

It is, therefore, my recommendation that we return to the operational set of criteria which will apply to all test operations, both weapons testing and nuclear reactor testing. The levels I recommend are 3.9 R per calendar quarter with the added provision that the Test Manager, acting upon the advice of his advisors, be authorized to extend a dose to as high as 25 R where exigencies of the program and the urgency of obtaining data so dictate. Further, that every operation be carried out with the minimum radiation exposure consistent with accomplishing the mission. The Test Manager and his staff of advisors, their laboratories, and the contractors, have, through the years, shown themselves to be extremely responsible individuals, who, under any criteria, have tried to perform their job in the safest manner possible consistent with reason. I see no evidence to indicate that future action will be otherwise. I, therefore, urgently recommend that the above criteria be adopted in order that the Test Manager may be able to properly carry out the requirements laid upon him by higher authority.

Very truly yours,

REYNOLDS ELECTRICAL & ENGINEERING CO., INC.

/s/ Clinton S. Maupin

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to the Test Manager